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Seeking the mission and opportunities for LIS in the AI era: a systematic review of empirical research on teenagers' artificial intelligence literacy (TAIL)

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Abstract

Introduction. We conducted a systematic review of empirical research on Teenagers' AI literacy (TAIL), aiming to explore opportunities and future research directions for the LIS field in TAIL studies.

Method. We conducted this study using the four-element framework of systematic review. After two rounds of screening, a total of 41 articles were ultimately included in this study.

Analysis. We conducted a coded analysis of the included articles based on the RQs.

Results. We identified 3 categories of research topics: TAIL education/cultivation, scale development, and relationship exploration. We also summarised 3 research patterns: Design-Implementation-Validation pattern, Investigation-Exploration pattern, and Hypothesis-Verification pattern.

Conclusion. We found that despite existing AI literacy practices for teenagers in the LIS field, current research with distinct LIS characteristics remains scarce. Future efforts should clarify the responsibilities and role of LIS in TAIL research and practice, leveraging its resource advantages, practical field strengths, and information perspective. Furthermore, this study outlines future research directions based on these three strengths.

Introduction

AI literacy is a set of competencies that enables individuals to use AI as a tool, critically evaluate AI, communicate, and collaborate effectively with AI (Long & Magerko, 2020). In recent years, with the breakthrough development and application of AI technology, the importance of AI literacy has become self-evident.

The World Health Organisation defines teenagers as individuals aged 10-19 years. 'Teenager' is a critical life stage between childhood and adulthood. Teenagers largely overlap with 'generation α ' (Jha, 2020). They are the first generation to live in the age of AI, living in a highly digitised environment from birth, interacting frequently with AI technologies and products. However, Teenagers are susceptible to the influence of the external environment (Shaffer, 1996), especially in the face of new technological products and controversial information, they have insufficient discernment and are prone to behavioral bias. As a result, teenagers are also more affected by the negative effects of AI applications, such as AI addiction and bias (Russell et al., 2015). Therefore, it's crucial to expose them to AI concepts and principles as early as possible, not only to help them develop the ability to adapt to AI environments (Touretzky et al., 2019) but also withstand the risks of AI applications. However, AI-related concepts are generally abstract and interdisciplinary in nature, making them challenging to teach to teenagers (Hayes & Kraemer, 2017). As teenagers are in a special period of transition from childhood to adulthood, the attention deficit is more selective and planned than in childhood, but much less persistent than in adults (Shaffer, 1996). Therefore, research on teenagers' AI literacy (TAIL) should respect the characteristics of teenagers.

Since the concept of information literacy was first proposed in the 1970s, 'literacy' has remained a central research topic in the field of Library and Information Science (LIS). The International Federation of Library Associations and Institutions (IFLA) has explicitly outlined libraries' crucial role in developing users' AI-related skills and competencies in documents like the 'IFLA Statement on libraries and artificial intelligence'. Over the past three years, AI literacy has also emerged as a prominent research focus within LIS. The unique value of libraries in AI literacy research has been recognised (Ali & Richardson, 2025). Therefore, it is both reasonable and necessary to conduct research in the field of LIS toward TAIL.

This study believes that the unique characteristics of the teenager offer new entry points and opportunities for literacy studies within the LIS field. At the same time, we believe that compared with theoretical research and traditional reviews, empirical research can present a clearer picture of what current research has been done, helping us to quickly locate future directions. Based on this, this study reviews relevant literature on the topic of TAIL, aiming to explore opportunities for LIS in TAIL research and identify future research directions.

Methodology

A systematic review focuses on the detailed research question and aims to provide evidence of a subject or research area (Moher et al., 2009). To conduct this study, we follow the four-element framework put forward by Gough et al. (2017), and propose our detailed RQs as follows:

RQ1: What are the research topics on TAIL? What research methods and tools are used respectively?

RQ2: What research patterns exist for TAIL?

RQ3: Which studies explore TAIL from the LIS perspective? What are the gaps in existing research from LIS perspectives?

Search terms and retrieval strategy

Our research topics encompass the keywords AI literacy and teenager. Based on considering synonyms of keywords, we noticed that the age range for teenagers encompasses educational levels such as K-12 education. Therefore, supplementary search terms can be expanded to include primary school, middle school, high school, K-12, and student. Therefore, we developed a Boolean search string as follows: ('AI literacy' OR 'artificial literacy') AND (teen* OR child* OR adolescent* OR young* OR 'K 12' OR 'K-12' OR 'primary school' OR 'middle school' OR 'high school' OR student). We adopt this search string in the article title, abstract, and keywords. We limited the time to '2015–2025' and the language to 'English'. The strategy above was applied to the following four databases: WOS, ACM digital library, Wiley online library, and Elsevier ScienceDirect. Based on the characteristics of different databases, specific search queries should be appropriately adjusted according to the query construction rules of each database.

Selection strategy

Two rounds of screening were conducted to select relevant articles.

The first round of screening aims to filter out literature unrelated to TAIL based on titles and abstracts. We employ the following three criteria for literature exclusion:

- (1) Non-English articles.
- (2) Domain irrelevant: With no significant correlation to AI literacy.
- (3) Topic irrelevant: With no significant correlation to Teenager.

The second round of screening involved full-text screening. To ensure the included literature aligned with the research objectives and questions, we added four screening criteria:

- (4) Low domain relevance: 'AI literacy' is mentioned, but not the primary focus.
- (5) Low topic irrelevance: 'Teenager' is mentioned, but not the primary research subjects, or the subjects' ages fall outside the teenager range (aged 10–19).
- (6) Exclude articles that are not empirical studies. Exclude some theoretical studies and reviews.
- (7) Low quality. We assess quality based on whether the research is complete and standardised. Some shorter exploratory posters and lead-ins will be excluded.

Data extraction strategy

A top-down code of articles' content was developed for data extraction. We extracted general information from the included articles (authors, titles, publication years), research topics, research methods and tools, and research design elements (research methods, sample size, sample population background). Through full-text screening, we conducted content analysis of the included articles across three dimensions: research topics, research methods, and research design.

Results

Through our search strategy developed earlier, we searched in December 2025. We have retrieved 2041 articles in 4 target databases distributed as follows: WOS 903, ACM digital library 400, Wiley online library 391, and Elsevier ScienceDirect 347. Removing duplicates resulted in 1511 articles. Specifically, during data collection, we observed that search results yielded a large number of articles exploring topics such as AI applications in child psychology and pediatrics. These clearly did not align with the research questions of this study. Therefore, we conducted data preprocessing, performing a 'quick screening' based on articles' titles to identify 124 documents potentially relevant to our research theme.

After two rounds of screening based on the exclusion criteria, 37 documents were included. Indeed, 4 articles were included through web tools based on references provided in the articles included before. Of these, 41 eligible articles were included. Figure 1 summarises the process of articles identification.

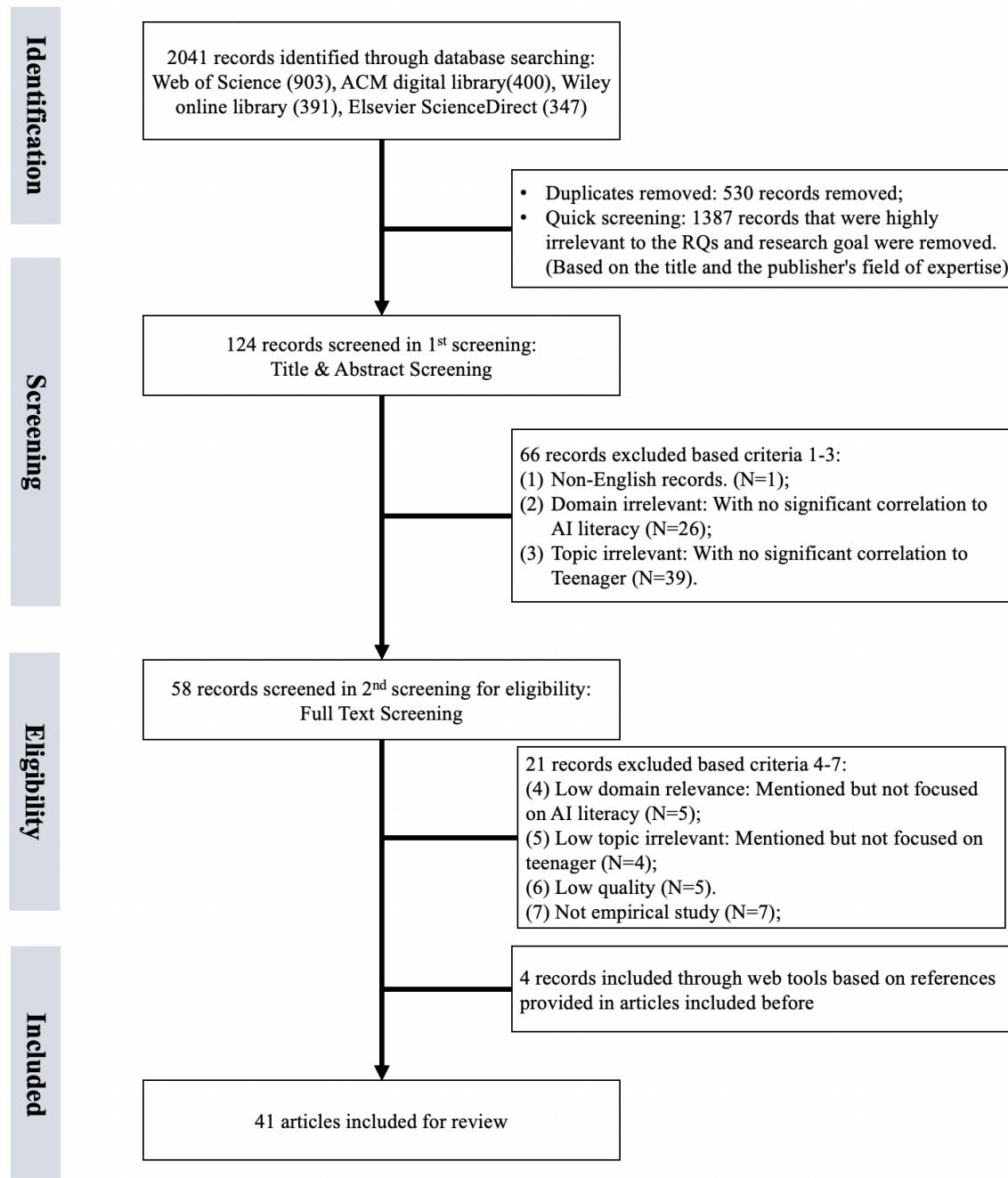


Figure 1. Flow diagram of the article selection.

General information about the articles

(1) Publishing time. The publication years of the included articles are concentrated between 2016 and 2025. 3 articles were published between 2016 and 2020, while 10 articles appeared between 2021 and 2023. The highest publications occurred in 2024 and 2025, with 12 and 16 articles,

respectively. This indicates that TAIL is experiencing a growing research trend and has garnered significant academic attention in recent years.

(2) Paper type. The included articles comprise 17 conference articles and 24 journal articles. Of these, up to 10 journal papers were published in 2025.

RQ1: Topics and methodologies identified

Through a content analysis of the 41 articles included in this review, we summarised the research topics of each article and finally identified 3 research topics based on the main research content of the articles: TAIL education/cultivation, scale development, and relationship exploration. We also identify the methods commonly used for different research topics (see Table 1).

Research topic	Research content	Methodologies	Number of articles
TAIL Education/Cultivation	To cultivate AI literacy among teenagers, conducting surveys, designing theoretical frameworks, or developing interventions (like programs, workshops, toolkits, curricula, and so on).	Mixed-method research approaches, including quasi-experimental studies, questionnaires, and interviews, combine qualitative and quantitative methodologies.	34
Scale Development	Developing an AI literacy-related scale for teenagers in accordance with scale development principles and processes.	Quantitative analysis based on questionnaire surveys.	4
Relationship Exploration	Analysing the relationships among variables such as AI literacy, attitudes toward AI, self-efficacy in learning AI, and AI readiness among teenagers.	Quantitative analysis based on questionnaire surveys, including SEM.	3

Table 1. Topics and methodologies of included articles

Due to space constraints, we focus on an in-depth analysis of the most extensively researched topic: ‘TAIL Education/Cultivation’. Articles in this topic exhibit the following 4 major characteristics:

(1) Using diverse teaching methods and tools. Existing research has applied various approaches tailored to teenagers' unique characteristics, including digital story writing (DSW) (Ng et al., 2022), co-creation and hands-on activities (Bendeche et al., 2021; Dangol et al., 2025; Okolo, 2024; Ng et al., 2024a), project-based learning approaches (Kong, Cheung & Tsang, 2024), constructivist teaching methods (Lin & Dai, 2025), and interactive teaching methods (Zhang et al., 2023) in intervention development. Specifically, open-source AI tools like Scratch, Teachable Machine, and Machine Learning for Kids have been integrated into interventions to enhance teenager engagement and learning outcomes (Kandlhofer et al., 2016; Klemetilä et al., 2025; Kong et al., 2024; Lin & Dai, 2025; Ng et al., 2022; Sharma, Klemetilä & Tanaka, 2025; Simbeck & Kalff, 2024; Touretzky et al., 2025; Yue et al., 2025). In particular, Wu et al. (2024) used a large language model to summarise key teaching methods based on an analysis of course instructional videos, suggesting that there is a significant association between the adoption of teaching methods and the development of advanced AI literacy.

(2) Emphasising AI ethics and career development. Critical understanding of AI and AI ethics constitute essential components of AI literacy. 9 articles, including one by Barber et al. (2024), highlight the cultivation of AI ethics and critical understanding among teenagers in their research. Solyst et al. (2025) and Klemetilä & Tanaka (2025) mentioned the term of ‘critical AI literacy’. Furthermore, teenagers are at a pivotal stage of career awareness, and existing studies frequently link AI literacy to their STEM career choices (Bendeche et al., 2021; Lee et al., 2021; Yang et al., 2024; Zhang et al., 2023).

(3) Focusing on GenAI application scenarios. GenAI has emerged as a significant application scenario in AI over the past two years, and teenagers' understanding of GenAI and their ability to use it are also considered key components of AI literacy (Adisa & Adefisayo, 2025; Botta et al., 2025; Cao et al., 2025; Wong & Chiu, 2025).

(4) Focusing on vulnerable groups. AI applications may create new technological divides. Among the selected articles, 3 articles focus on vulnerable youth groups (Bendeche et al., 2021; Cao et al., 2025; Mertala, Fagerlund & Calderon, 2022; Okolo, 2024), who face challenges in accessing AI, and discuss how to help them enhance their AI literacy.

RQ2: Research patterns identification based on the research process

Based on the research designs and methodologies of the included studies, we have identified 3 research patterns in current TAIL research:

Pattern 1: Design-implementation-validation pattern (N=24). Research topics under this pattern include 2 topics: 'TAIL education/cultivation' and 'scale development'. For the topic of 'TAIL education/cultivation', the typical research pathway involves designing workshops, curricula, games, etc., which are tailored to teenager characteristics. Teenager participants are then recruited for experiments or pilot study (Han et al., 2018; Henry, Hernalesteen & Collard, 2021; Tseng et al., 2024; Voulgari et al., 2021; Kenny et al., 2025). For example, Petridis et al. (2023) designed an AI knowledge adventure game for students aged 7–12 and conducted experiments to validate the game's effectiveness in enhancing AI literacy. For the topic of 'scale development', the research pathway primarily involves designing scales related to TAIL, collecting practice data based on the scale validation process, and verifying the scales' validity (Chung et al., 2025; Kong & Zhu, 2025; Ng et al., 2024; Zhang, Perry & Lee, 2025).

Pattern 2: Investigation-exploration pattern (N=8). Research topics under this pattern include 'TAIL education/cultivation'. The research pathways within this pattern comprise three approaches: (1) Conducting interviews and questionnaire surveys with teenagers to understand their AI cognition, perceptions, and imagination, laying groundwork for subsequent AI literacy cultivation (Adisa & Adefisayo, 2025; Botta et al., 2025; Cai, 2024; Mertala, Fagerlund & Calderon, 2022; Sharma, Klemettilä & Tanaka, 2025); (2) Analysing changes in naive conceptions and reasoning abilities based on literacy intervention (Kim et al., 2023; Dangol et al., 2025; Cao et al., 2025); (3) Analyse AI education classroom data based on technical methods to identify learning theories, pedagogical methods and AI literacy levels in AI classroom instruction (Wu et al., 2024).

Pattern 3: Hypothesis-verification pattern (N=3). This research pattern is applied to the 'relationship exploration' topic, typically involving the formulation of hypotheses regarding the relationships between variables such as AI literacy and AI attitudes. Data is collected by questionnaires and analysed to verify these relationships (Chai et al., 2021; Choi, Yang & Goo, 2024; Dai et al., 2020).

RQ3: TAIL from LIS perspective

The topic of AI literacy has already become one of the research hotspots in the field of LIS in recent years (Ali & Richardson, 2025; Bridges et al., 2025). However, research in the LIS field seems to have paid less attention to TAIL.

Strictly speaking, only three articles demonstrated distinctive LIS characteristics in their research. Among these, Cao et al. (2025) designed an AI literacy education program targeting students from underserved communities, identifying three types of cultural capital relevant to AI literacy education in library practice; Kandlhofer et al. (2016) emphasised differing learning priorities across age groups and developed four modular curricula tailored to kindergarten/elementary school, middle school, high school, and university levels. Specifically, Wong & Chiu (2025) focuses

on school libraries and analyse what librarians can do for student 12th graders to help them improve their AI literacy based on the Big Six Information Literacy model.

Although current scientific research with distinct LIS characteristics remains limited, we recognise that LIS has already undertaken some practical initiatives addressing TAIL. For instance, St. Louis County Library released the '*artificial intelligence (AI) 2025 guide: AI for kids and teens*', providing youth with AI literacy materials and resources. This suggests that within the LIS field, TAIL may exhibit a trend where practical implementation leads academic research.

Whether from the perspective of research methodology or research themes, the current research on TAIL overlaps with the literacy research that has been conducted in the LIS field, which can provide us with references and help in conducting research from the perspective of LIS, and this is the significance of this review, which we will discuss in the next section.

Discussion and conclusion

Responsibility reconstruction: the role of LIS in TAIL

Libraries are naturally equipped with the responsibility to carry out research and practice on TAIL. Current research focuses mostly on TAIL education from education perspective, and interventions like programs and workshops have been studied. These interventions focus on school teaching and match the context of curriculum teaching. This requires teenagers to be mostly in the learning context when participating in the activities. However, learning explorations in non-instructional contexts should also be explored. Researchers in the LIS field are not traditional educators of TAIL but should play the role of guides and connectors. Research on TAIL in the LIS field could use library activities as an entry point to design non-instructional interventions, carry out non-curricular instructional activities, and introduce intergenerational parent-child interactions, which would be conducive to breaking down the limitations of the pedagogy of the school field.

Furthermore, as public cultural service institutions, libraries inherently bear the responsibility to bridge the digital divide and promote cultural equity. In TAIL research, libraries must prioritise marginalised groups. By leveraging public libraries, community libraries, and school libraries as research and practice hubs, libraries can safeguard these groups' rights to equal access to AI-related knowledge and skills, taking action to enhance their AI literacy.

Opportunities and challenges: leveraging the strengths and distinctive features of LIS

Actually, the research topics and approaches identified in this review have already been explored within the LIS field's existing studies on literacy. This study concludes that the LIS field has three major advantages for conducting TAIL research: information perspective, physical space for research and practice, and abundant resources.

This leads to three directions for the LIS field to conduct TAIL research in the future: (1) Conduct TAIL research from an information and interaction perspective. The LIS field has accumulated a large number of theoretical foundations in long-term information literacy research, and these can be extended for TAIL cultivation (e.g., Wong & Chiu, 2025). Conducting research from the LIS perspective means viewing AI technologies and products as assistants to human beings' work in dealing with the information world. It's capable of expanding the research context of TAIL from the learning context into the life context, which is also conducive to the innovation and expansion of research methods suitable for teenagers (e.g., interactive teaching, heuristic teaching, etc.); (2) Using the physical space of libraries provides a user gathering place and experimental field for TAIL research. In addition to the classroom, the library is an important place to gather teenagers and their parents, which has a natural advantage for conducting user experiments; (3) The development of TAIL intervention based on library resources. Existing youth-oriented research is mostly a combination of curricular knowledge units or the use of existing tools (e.g., teachable

machine, etc.). The libraries' collection resources can effectively deal with the interdisciplinary attributes of youth AI literacy and can be utilised to break the disciplinary barriers for the development of interventions.

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